NSCI 120 Syllabus Spring 2015

COURSE OBJECTIVES AND OUTCOMES:

Students learn the process of scientific research by investigating an open-ended research challenge posed by local laboratories from the Texas Medical Center & Rice University. Teams of students work in developing and characterizing diverse research methods to address the challenge.

Course objectives. Students should learn:

1. How to address an open-ended research challenge,
2. To work collaboratively on a team to apply the scientific method solving the challenge,
3. To communicate the critical steps in the research process in written and oral formats.

Course outcomes/skills. : At the end of the class students will have gained skills relevant to their future laboratory work both in teaching and independent research labs. Students completing this course should be able to:

1. Understand a research question, both the 'big picture' and specific challenge,
    a. How to define a goal for a research project;
    b. How to determine if/when the goal is achieved;
2. Conduct background research in the existing literature to understand a research challenge and identify relevant published work relevant to the question at hand;
3. State a clear hypothesis they can test;
4. Design an experiment, effectively incorporating both positive and negative controls, and articulate how the experiment will prove or disprove the hypothesis;
5. Conduct the experiment, keeping a detailed notebook describing their experimental design, recording all research activities, and collecting the obtained data and communicating a clear conclusion for each experiment;
6. Learn basic laboratory skills relevant to their project area;
7. Interpret the data collected and articulate conclusions supported by their observations;
8. Understand how negative results can advance their research goals and appropriately re-design their project;
9. Communicate their research findings in written and oral formats.

Team Formation and Expectations

Active, productive engagement is expected of all students. Teams will be formed based on student interest and skills. Students will work in their research team throughout the entire semester. Students will have research team meetings during most class periods. For this reason, attendance in class is required of all students except for illness or family emergency. *Research teams are also expected to meet outside of class. Expect to spend <u>at least 5 hrs</u> per week in the lab working on your research project.*

Each member of the team is expected to contribute equally to the project. While the types of contributions will vary, the effort should be comparable. It is also important that regular team requirements rotate. For example, one person should not act as the recorder for every meeting; rather, everyone on the team should take turns with this job.

Peer evaluation of student design teams will be conducted using the online CATME system. Instructor input will be valued as well, using the process described below.

Prerequisites:
None

Meeting Time and Location:
T/TH 10:50 AM -12:00 PM, Location GRB W114

Course instructors:
Dr. Sandra W Bishnoi
sbishnoi@rice.edu
BRC Room 174-cubicle
Office Hours: Monday/ Friday 9:30-11:30 AM in GRB W114 or by appointment

TA:

Method of Instruction:
Class will be based on short lectures addressing the steps of the scientific method and topics like searching the literature, defining a hypothesis, and the ethics of research, short -in class exercises and lab work conducted in class. Students will work with their teams during class, as well as having access to the lab at other times (TBD). TAs will always be able to work with students during normally scheduled lab time. If a student wants to work in the lab outside the normal lab time, there must be a TA or instructor supervising the lab, and the student must arrange for one of them to accompany them in advance. Project mentors/clients will be available by appointment to meet with teams.

Method of evaluation:

Notebook reviews	10%
Lab skills assessment	10%
Safety	10%
Scientific Process Assignments	30%
Communicating Results (written and oral)	30%
Project/team participation	10%
Total	100%

If you believe that a mistake has been made in grading your assignments, you have ONE WEEK to request a re-grade in writing. After one week has passed I will not consider any requests to re-grade your work.

Notebook reviews: Each student is expected to keep a laboratory notebook throughout the semester, in accordance to the guidelines that will be outlined in class. For each experiment, a clear description of the goal of the experiment, experimental plan, results and conclusions will be clearly written (it is important that others can read your work- so neatness counts!). Notebooks will be collected for grading and review 2-3 times during the semester. Here is a good site for proper research notebook layout along with examples: http://www.ruf.rice.edu/~bioslabs/tools/notebook/notebook.html.

Lab skills assessments: At the beginning of the semester, you will have lab skill assessments / tutorials, including one that is specific to your project. This is especially important for those of you who are taking this class as a prerequisite for BIOC 211.

Safety: Following all safety rules for a laboratory is critically important, especially when working with chemicals and hazardous materials. There will be a safety quiz on the second day of class that will test whether you understand the basic safety rules. Wear proper attire (long pants, closed toe shoes, safety gloves) and safety glasses will be necessary. A lab coat is recommended especially when working with various dyes. During the semester, if you are caught breaking any of the safety rules, then points will be deducted from a total possible points of 75. Please watch the safety video at https://www.youtube.com/watch?v=rMq3ABIITVc&feature=youtu.be.

Scientific process assignments: The goal of this course is to teach you the scientific process, so we will have periodic deadlines of work products (written and oral) that go over the steps of the scientific process.

Written reports are due into Owlspace by the deadline listed in the Assignment Matrix. Late assignments will have a 50% maximum grade and will only be accepted one week after the assigned due date. Written reports should be your own, but general methods of working problems may be discussed with others.

1. Problem statement: One paragraph describing the problem that you are trying to solve.
2. Hypothesis statement: One paragraph describing your proposed solution to the problem that is being addressed, along with a hypothesis of why you think the solution will work.
3. Oral presentation of the problem and hypothesis to class: *Your team will present your overall problem and hypothesis to the class.* Please limit your presentation to 4 slides.
4. Background literature: At least 5 primary literature references (not websites) should be collected regarding the problem that you are solving. A 2 page summary of the literature should be presented, along with proper citations being used.
5. Experimental design draft: A proposed design of the experiments that will be done to solve the problem should be presented, along with necessary citations. If equipment is needed that is not currently available in the class, then a plan to gain access to that equipment must be suggested.
6. Data collection (unprocessed data): At least two experimental results should be presented prior to any significant analysis and application of statistics
7. Final experimental design: After initial experiments have been executed and the results evaluated, the overall design direction should be reassessed. Any changes that you would like

to make (changes in technique, different growth conditions, etc.) should be suggested. The write-up should be no more than 2 pages long.

8. Data graphing, analysis, and application of statistics: You should report at least two results that you feel very confident in, including a proper graph of the data, written analysis and discussion of the result. Be sure to include relevant statistics and error bars.

All written assignments should be 1.5 spaced-spaced in 12-point Times New Roman font with 1-inch margins on each side. Your team name, the date, and the course/section should appear on the header of each page. References must be clearly cited in all written assignments. American Medical Association citation style should be used for all papers. Information on this citation format can be found here: http://medlib.bu.edu/facts/faq2.cfm/content/citationsama.cfm. The free reference manager, Mendeley (http://mendeley.com/), can be helpful in creating your bibliographies.

Communicating Results: Two oral presentations will be given to present your preliminary and final results during the semester. ***All team members must participate in all presentations***. The presentations will be no more than 10 minutes long and allow 5 minutes for questions from the audience. All clients will be invited to attend the final oral presentation on April 23, 2015.

You will deliver a rough draft and final draft of your written report that summarizes your results. The rough draft should include the following parts: Abstract, Introduction / Background, Methods and Materials, and your Preliminary Results. The Final draft should include Abstract, Introduction / Background, Methods and Materials, Results and Discussion, and Conclusion. The reports should be a team product and be approximately 10 pages in length.

Project /team participation: A team participation score will be given three times during the semester and will range from 0 to 25 points. The individual team participation grade is based on technical contribution, peer evaluation, instructor evaluation, self-evaluation, attendance, etc. Peer evaluation will be formally evaluated using the CATME software (you will receive an email asking you to participate, check your email). Participation also includes attending lab, completing assignments, contributing to class discussions, and arriving on time. You may have 2 unexcused absences. If you have a family emergency, an approved sporting event, or an illness that requires you to miss class, please inform me in advance.
The course instructor makes the final decision about a student's team participation score, which counts as 10% of the final grade

Honor System Policy: As with all endeavors at Rice, you are expected to adhere to the Honor Code and follow the guidelines given in the Blue Book. Exams are given under the honor system. Students are encouraged to work together collaboratively on the projects, but each student is expected to contribute an equal share to the final project. Plagiarism includes copying or using a resource without proper citation (to include appropriating the ideas of another person without accrediting the source). American Medical Association citation style should be used for all assignments where citations are

needed. Information on this citation format can be found here: http://medlib.bu.edu/facts/faq2.cfm/content/citationsama.cfm

Students are encouraged to bring any concerns involving academic integrity to the attention of the instructor. More information can be found at www.ruf.rice.edu/~honor**.** If at any point, you are unclear about the honor system and how it works, please contact me.

Disabilities: If you have a documented disability that requires accommodation, please let me know so that we can confidentially discuss your needs. You will also need to register with the Disability Support Services Office in the Ley Student Center.

Owlspace: All course readings will be uploaded onto OwlSpace. I will use this as a primary means of interfacing with the class outside of course times. Make sure to check this site frequently for course updates or additional course materials.

Extra credit: Extra credit opportunities will be presented throughout the semester. Any extra credit will be added to individual efforts, such as the exam, or the final grade. Extra credit opportunities may include completing pre- and post-assessment inventories, attending special seminars, completing mid-term and final assessments of the class, etc. Opportunities will be announced in class.

Expectations about E-mail and Laptop Use in Class: While you may use a laptop or a hand-held device during class, you should not be surfing the internet, reading e-mail, or sending text messages during the class period. I welcome e-mailed questions and concerns about your work and the course in general. Please ensure that your e-mailed notes include a salutation, closing statement and your full name. E-mailed notes should be written in a professional manner.

***This syllabus is a plan for the course, and is subject to change at the discretion of the instructor. Any changes will be announced. ***

Assignment Matrix	**Max Points**	**Date due, time**	**Location**
Pipetting pointillism	25	Tues, Jan 13 - Thurs, Jan 15	In class
Safety training video quiz	25	Thurs, Jan 15	In class
Initial team maker survey	25	Tues, Jan 20, 12midnight	CATME
Assignment of Teams	0	Thurs, Jan 22	instructor
Quantitative delivery of solutions (written report)	25	Fri, Jan 23, 2pm	Owlspace
Notebook review 1	25	Tues, Jan 27	In class
Use of a spectrophotometer	25	Friday, Jan 30, 2pm	Owlspace
Problem statement (written)	30	Mon, Feb 2, 12midnight	Owlspace
Project specific lab skill assessment (TBD)	25	Tues, Feb 3 - Thurs, Feb 5	In class
Hypothesis statement (written)	30	Fri, Feb 6, 2pm	Owlspace
Presentation of Problem and Hypothesis to class	**60**	**Thurs, Feb 12**	**OEDK**
CATME evaluation I	25	Friday, Feb 13, 2pm	CATME
Background literature collection and summaries	40	Mon, Feb 16, 12midnight	Owlspace
Notebook review 2	25	Thurs, Feb 19	In class
Experimental design draft (written draft)	30	Fri, Feb 20, 2pm	Owlspace
Data collection (unprocessed data, written draft)	30	Thurs, Mar 12	In class
Final Experimental design (written draft)	30	Fri, March 20, 2pm	Owlspace
CATME evaluation II	25	Friday, Mar 20, 2pm	CATME
Notebook review 3	25	Tues, Mar 24	In class
Data graphing, analysis, and application of statistics (written draft)	50	Thurs, Mar 26	In class
Communicating results: Presentation 1	**50**	**Thurs, April 9**	**OEDK**
Notebook review 4	25	Tues, April 21	In class
Communicating results: Final Presentation	**100**	**Thurs, April 23**	**OEDK**
CATME evaluation III	25	Friday, April 24, 2pm	CATME
Communicating results: Rough draft of final paper (Abstract, Intro/Background, Methods and Materials, Results)	50	Friday, April 24, 2pm	Owlspace
Communicating results: Final draft of paper	**100**	**Due at "final" time assigned by Registrar**	**Owlspace**
Overall Safety Score	75	Throughout semester	In class
Overall points:	**1000**		